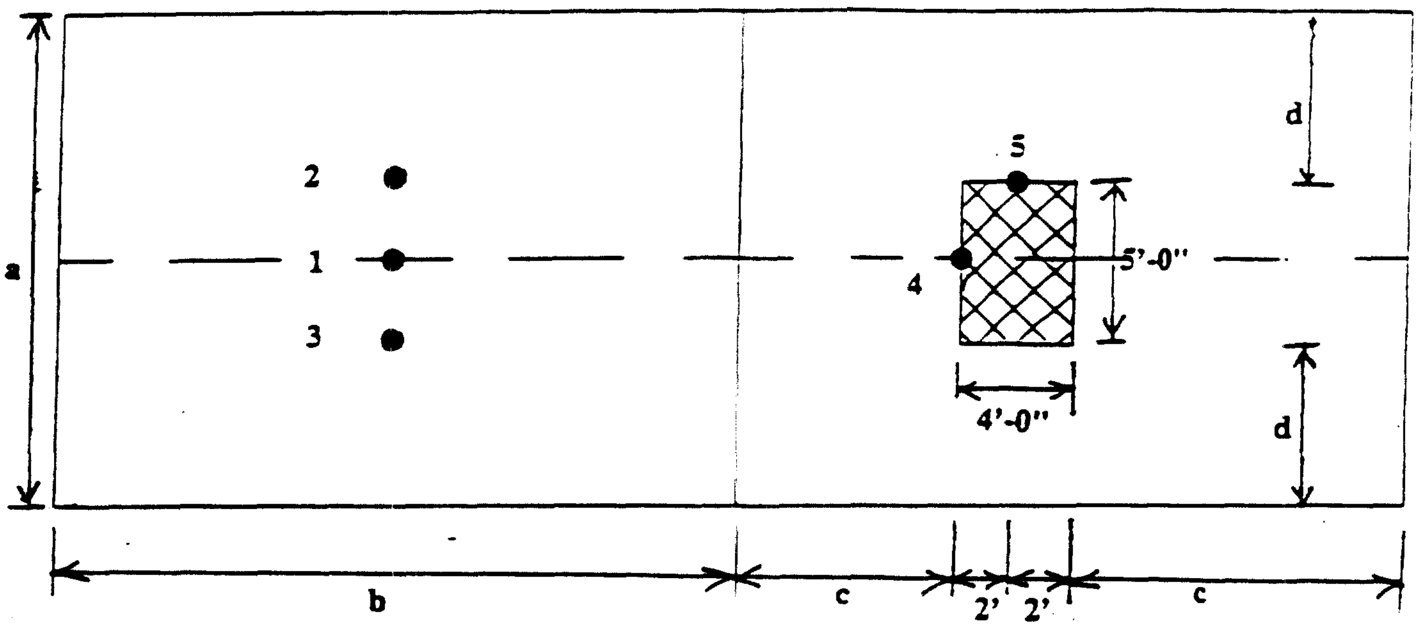

NOTE : ● Designates Loading Position

For Calvert Street : a = 130" b = 184" c = 68" d = 35"

For Jefferson Ave. : a = 130" b = 176" c = 64" d = 35"

For Wasson Road : a = 120" b = 178" c = 65" d = 30"

FIG. 3.5. Plan View of Test Sections for Mock Cuts

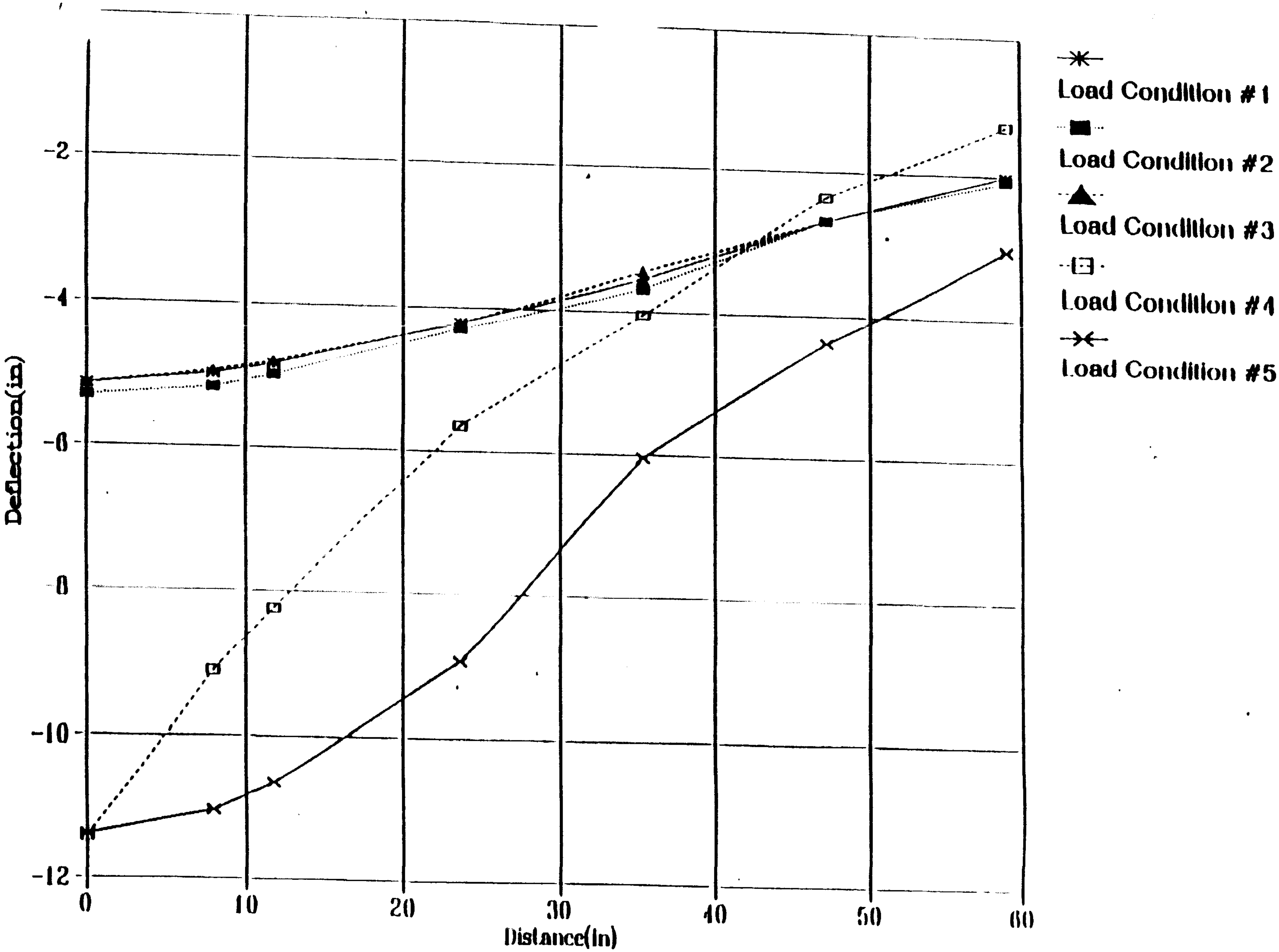

FIG. 3.6.a. FWD Deflection Profiles for Wasson Road

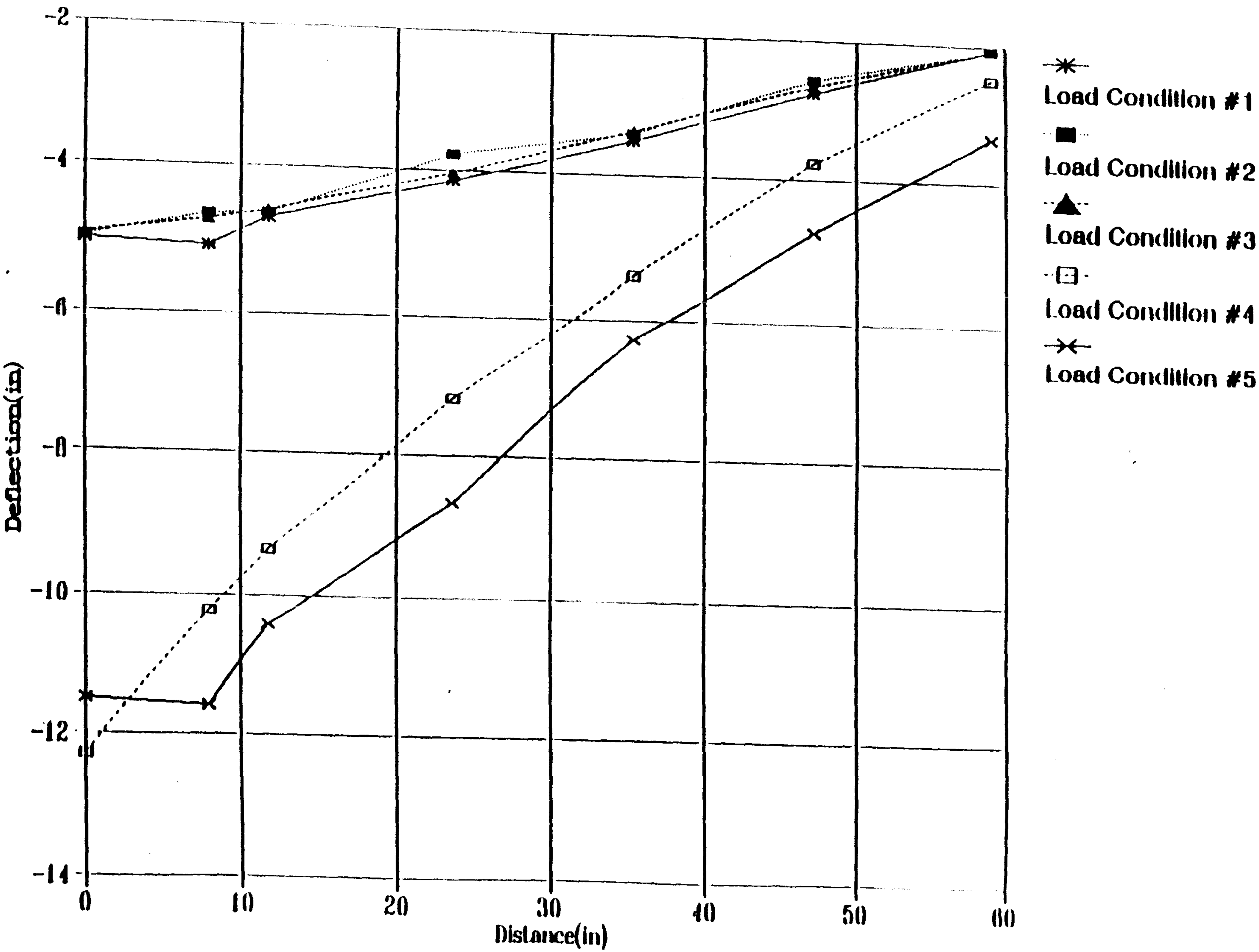

FIG. 3.6.b. FWD Deflection Profiles for Calvert Street

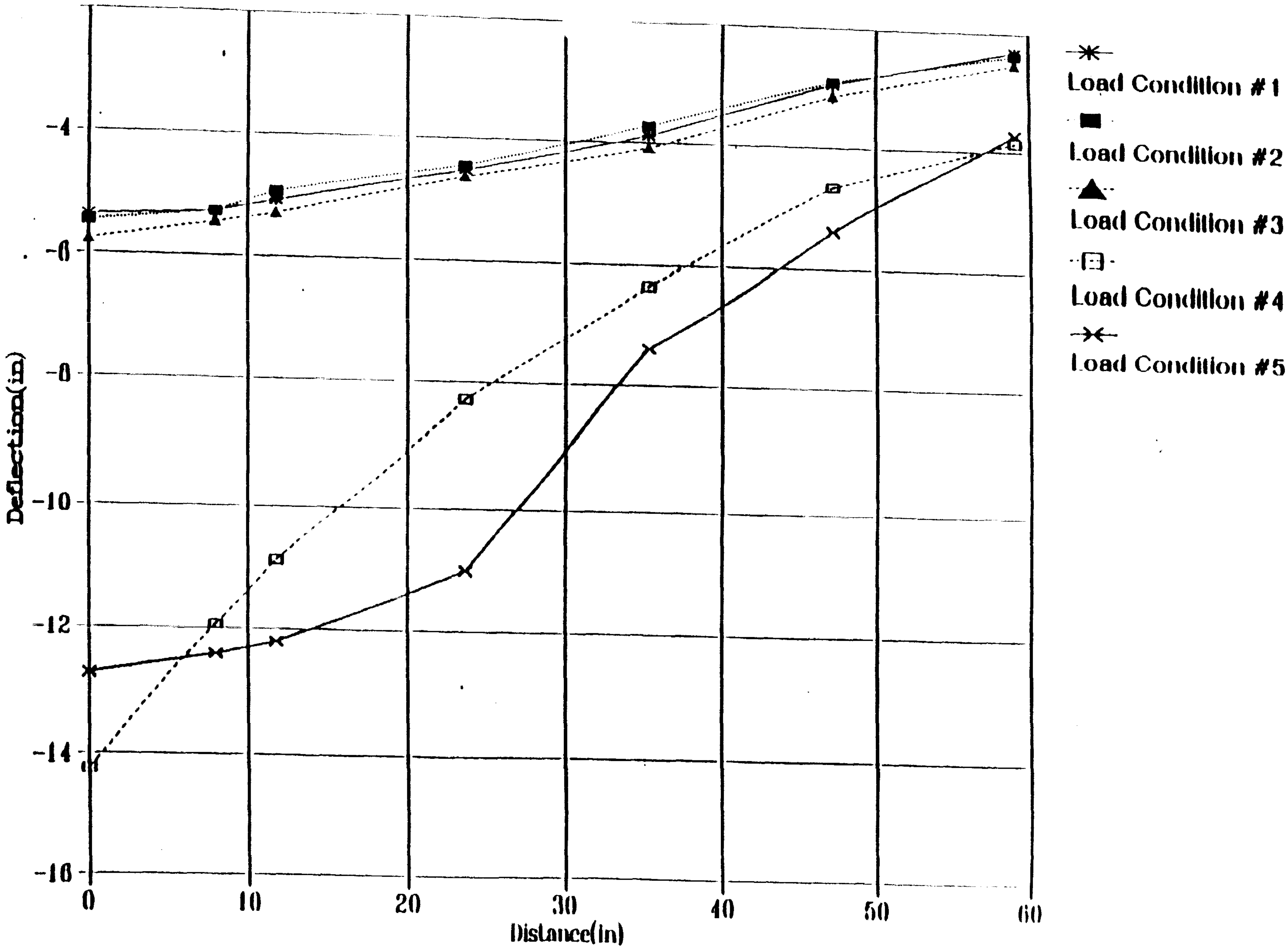

FIG. 3.6.c. FWD Deflection Profiles for Jefferson Avenue

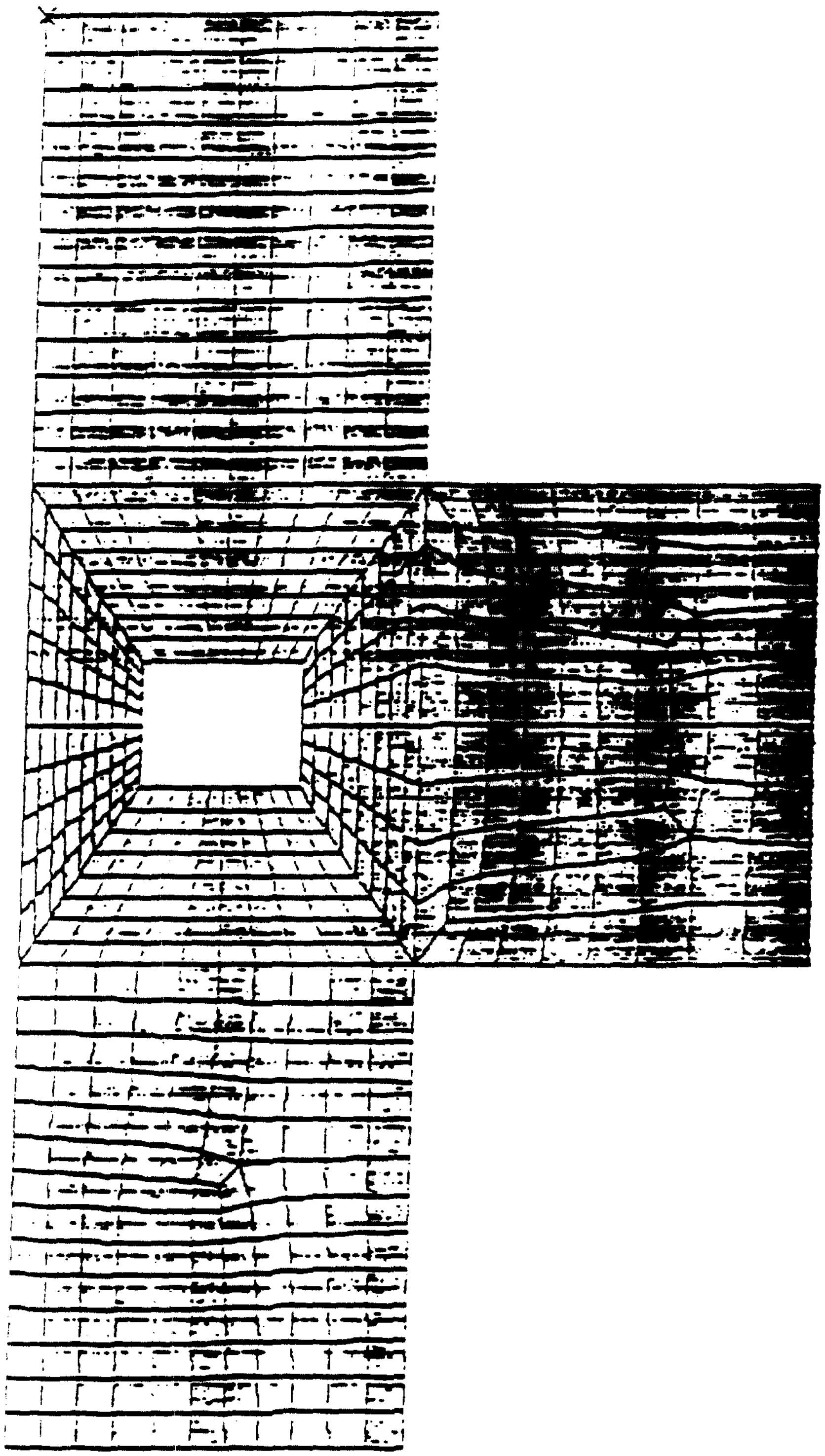

FIG. 3.7. Mesh Configuration for the Mock Cuts

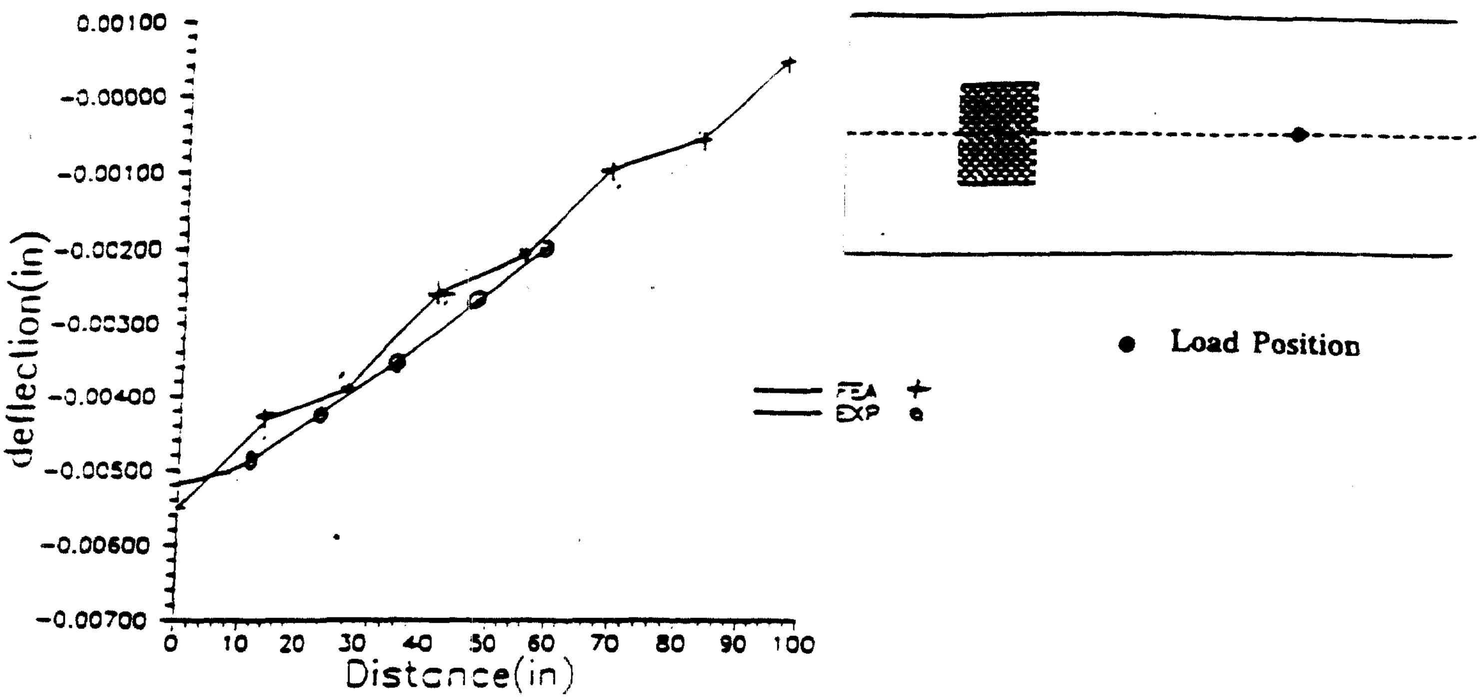

FIG. 3.8.a. **Deflection Profiles for Wasson Road (Control Section)**

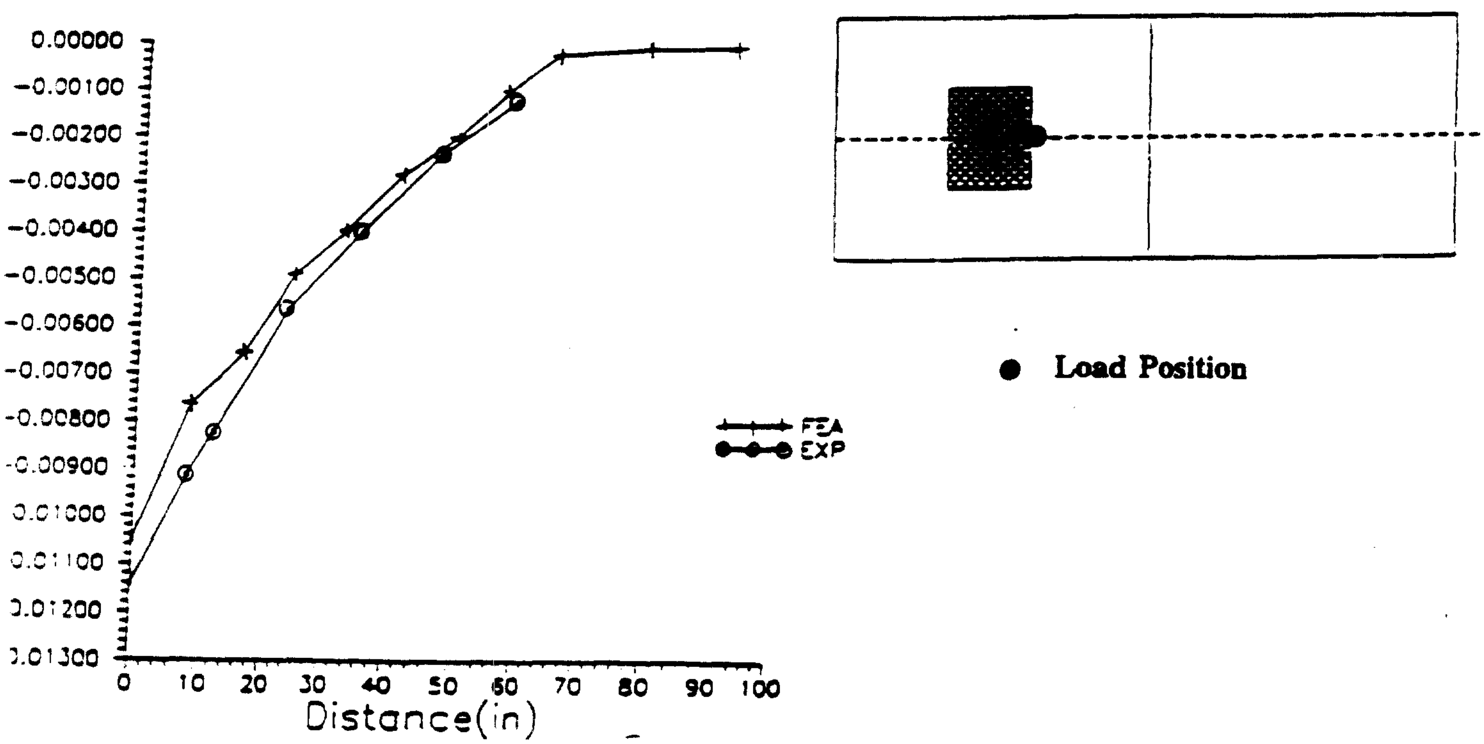

FIG. 3.8.b. **Deflection Profiles for Wasson Road (at Cut)**

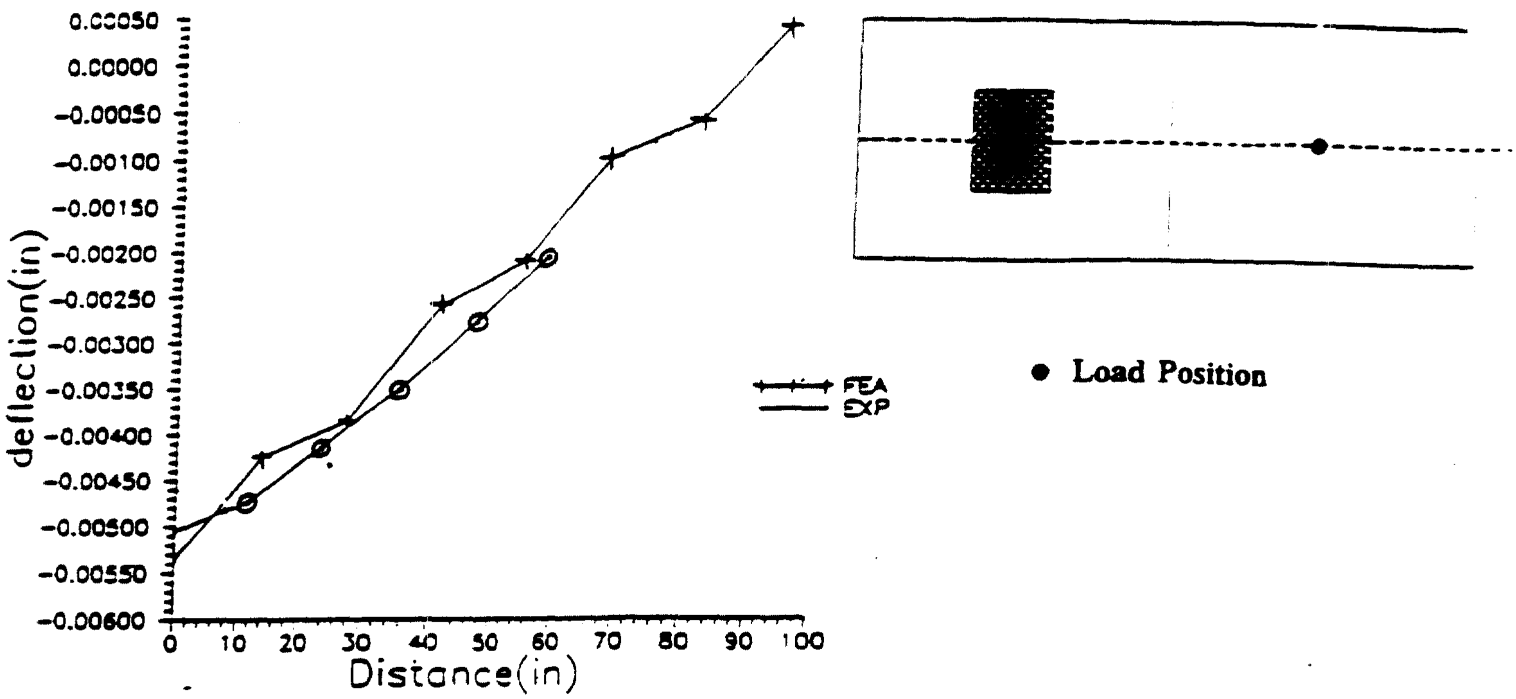

FIG. 3.9.a. Deflection Profiles for Calvert Street (Control Section)

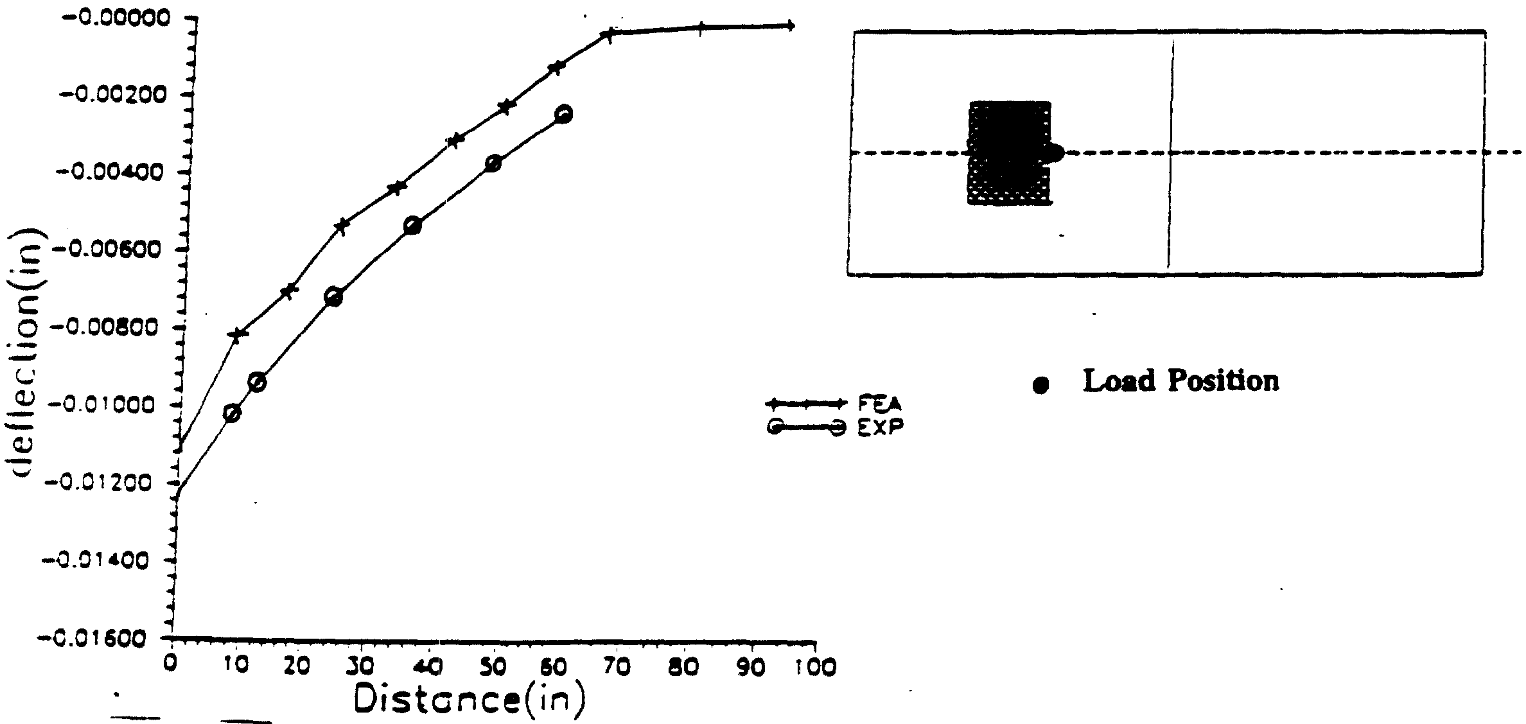

FIG. 3.9.b. Deflection Profiles for Calvert Street (at Cut)

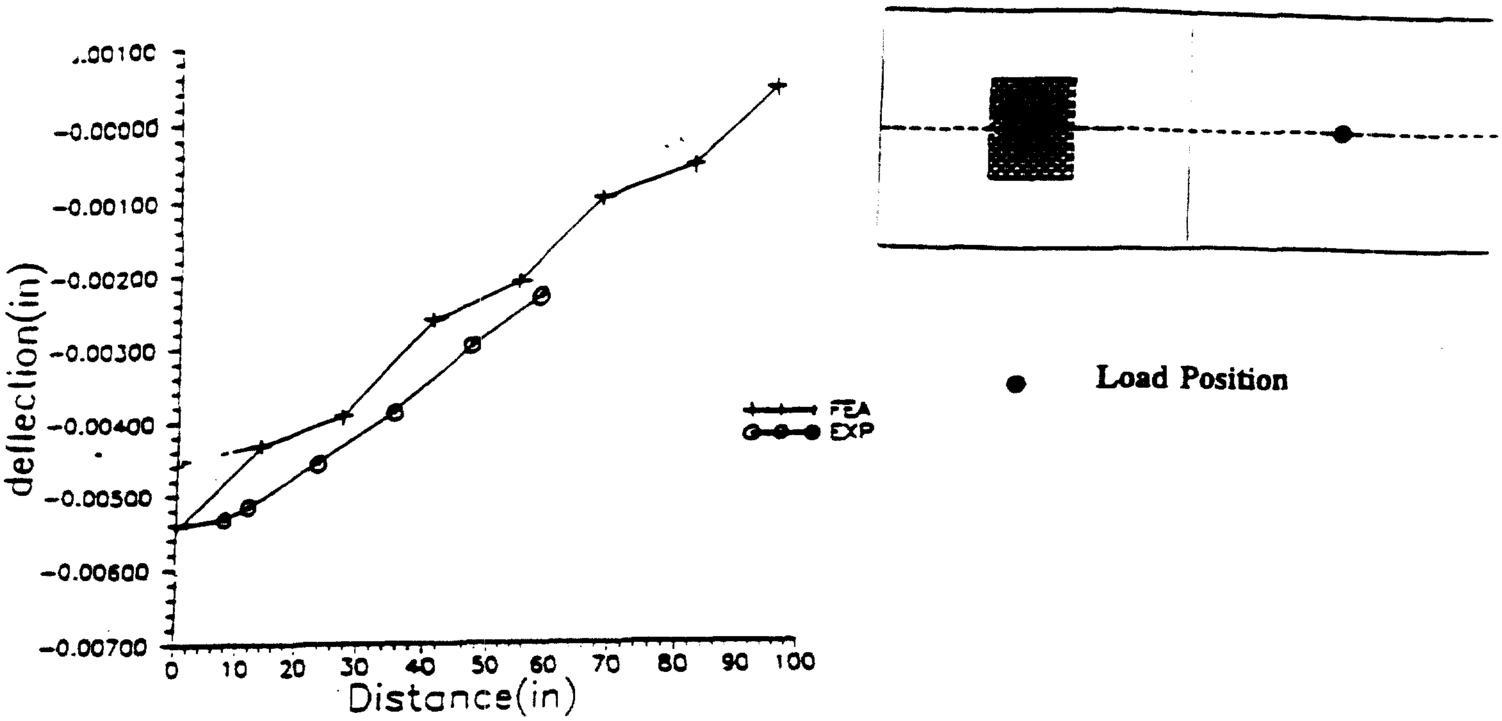

FIG. 3.10.a. Deflection Profiles for Jefferson Avenue (Control Section)

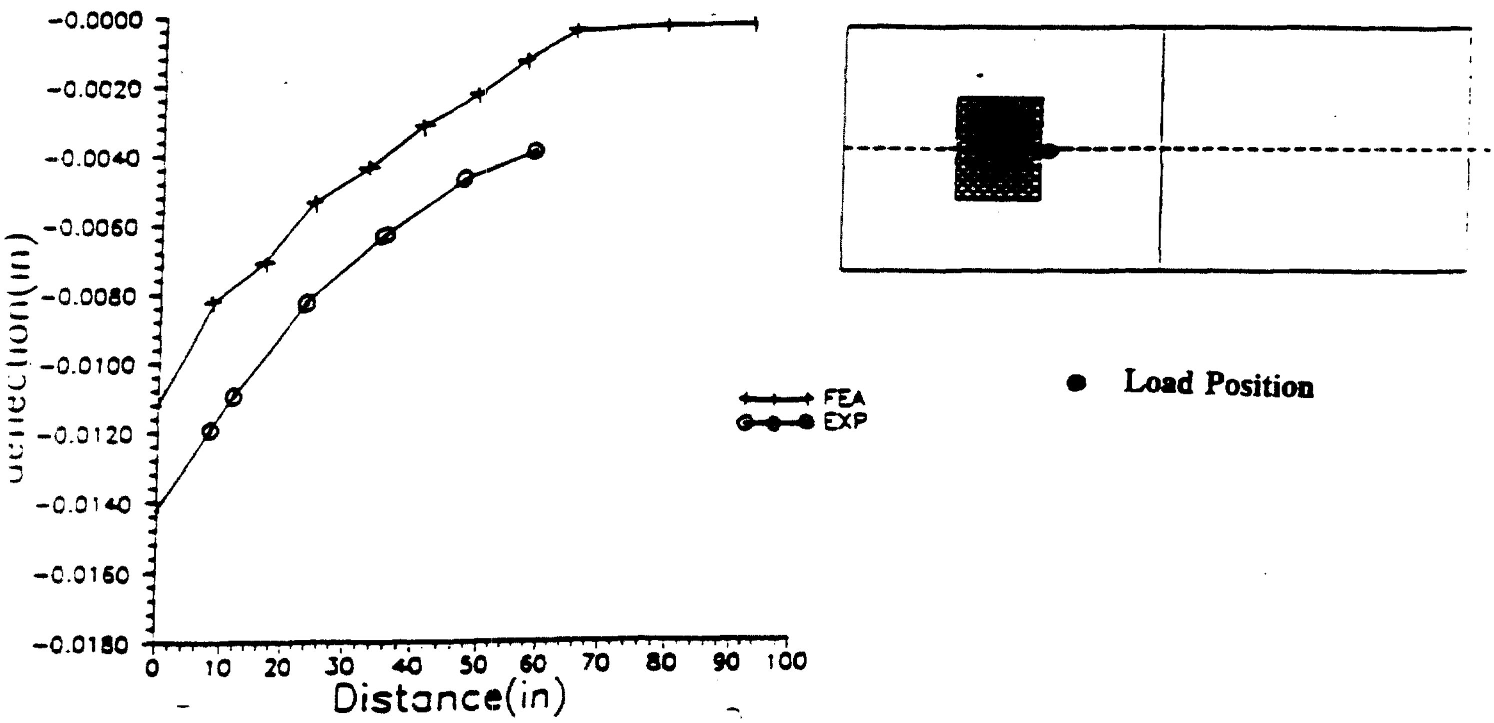

FIG. 3.10.b. Deflection Profiles for Jefferson Avenue (at Cut)

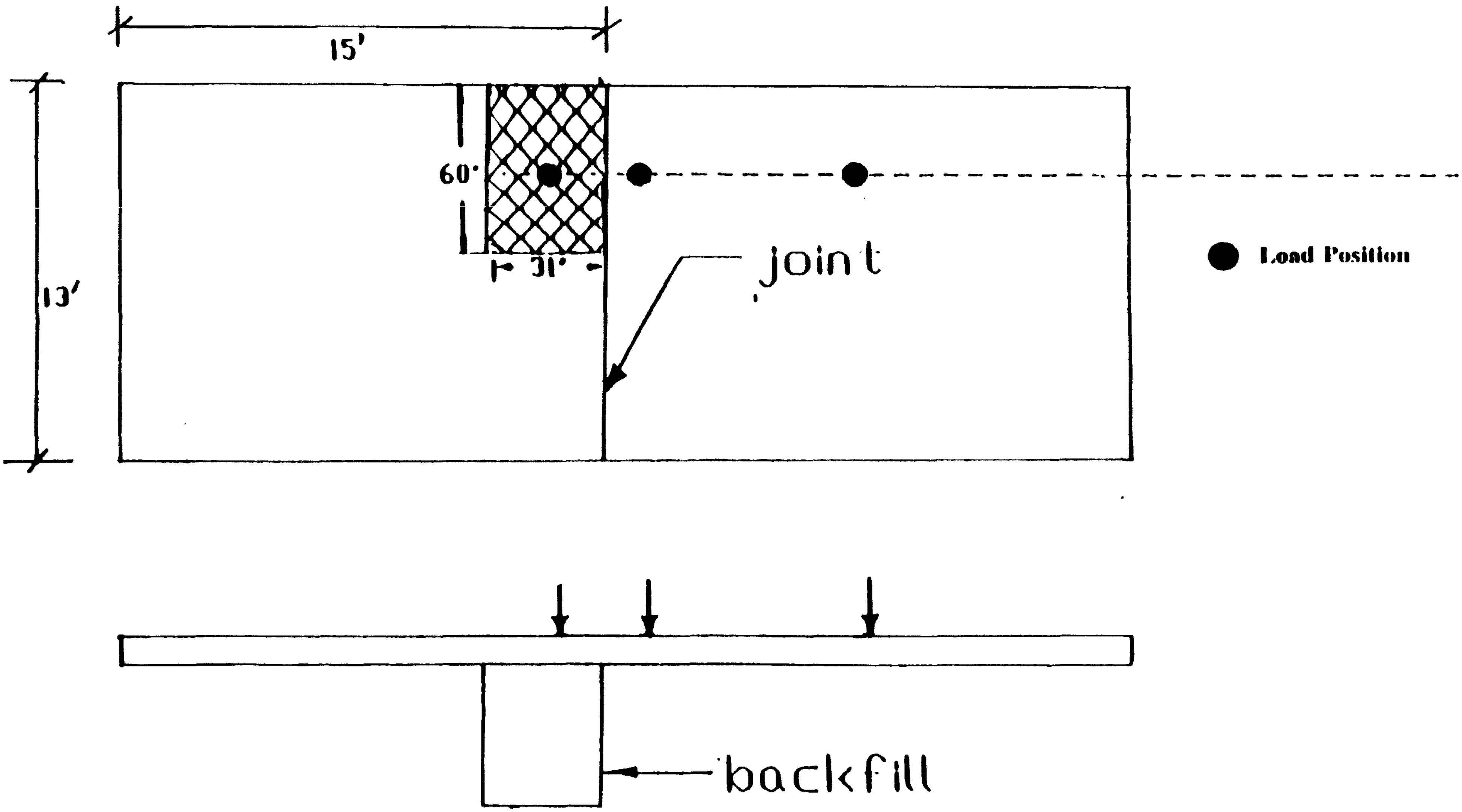

FIG. 3.11. Layout for Dynaflect Tests on Calvert Street

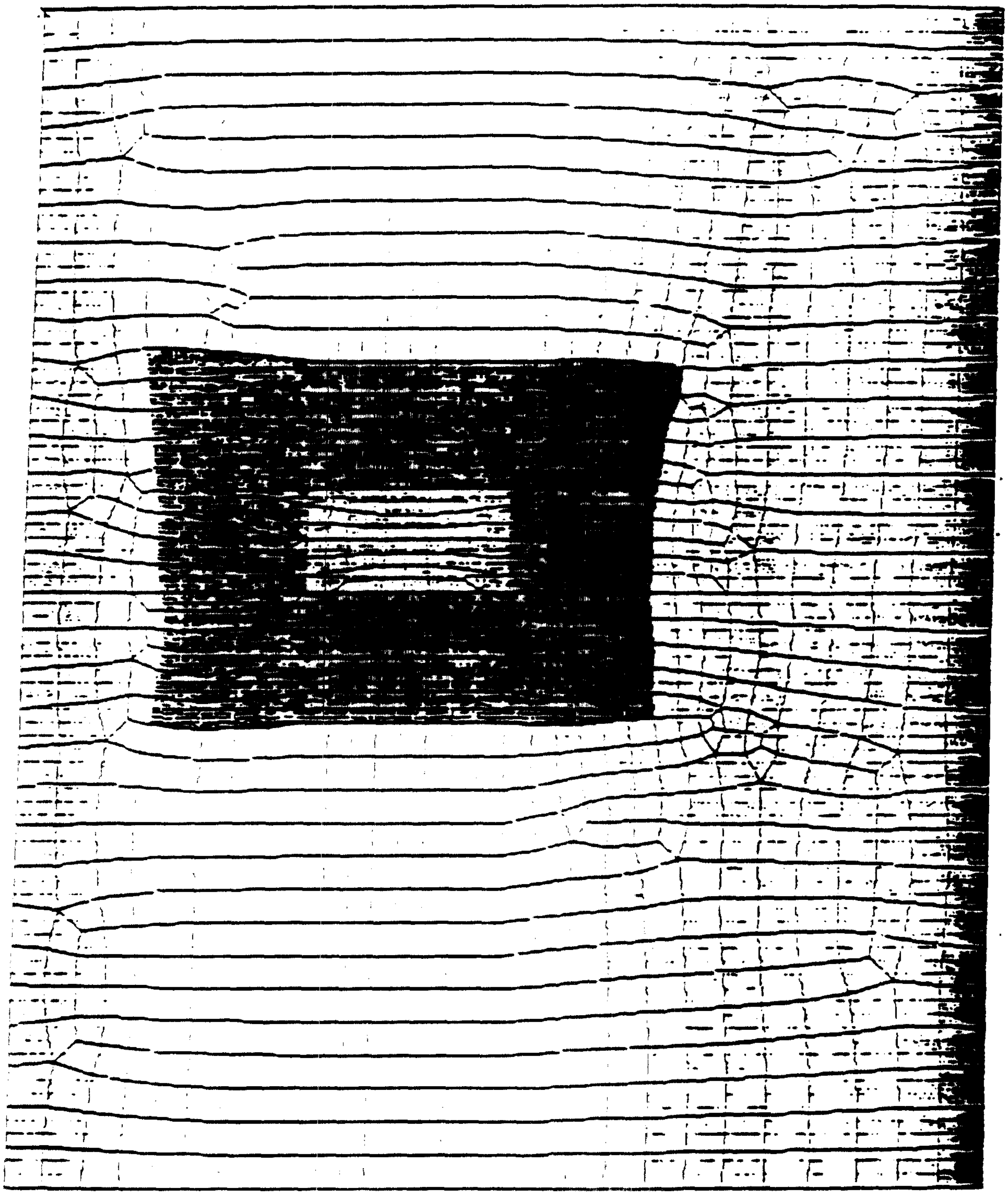

FIG. 3.12. Mesh Configuration for Dynaflect Test Modeling on Calvert Street

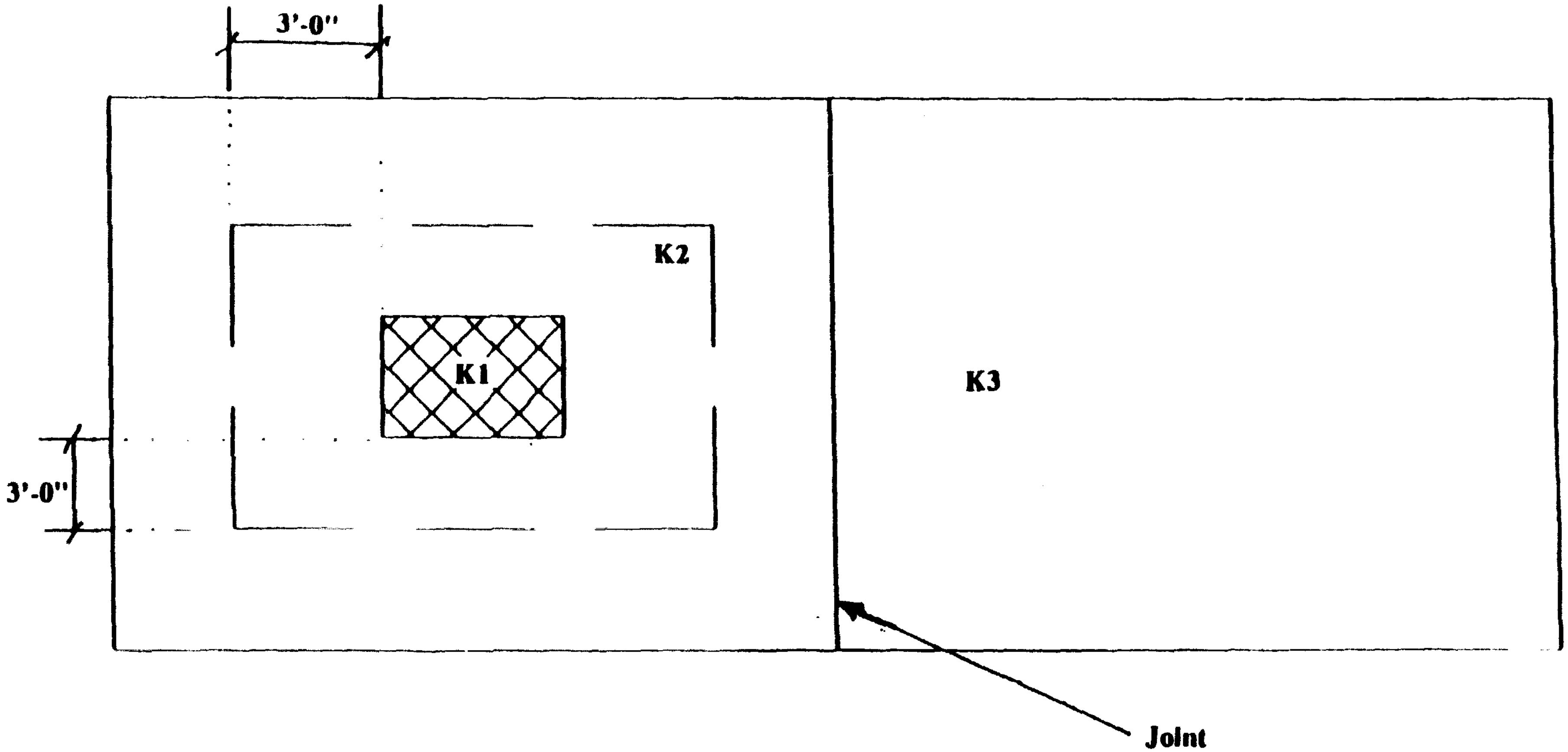

FIG. 3.13. Variation of k in the Different Regions for FE Idealization

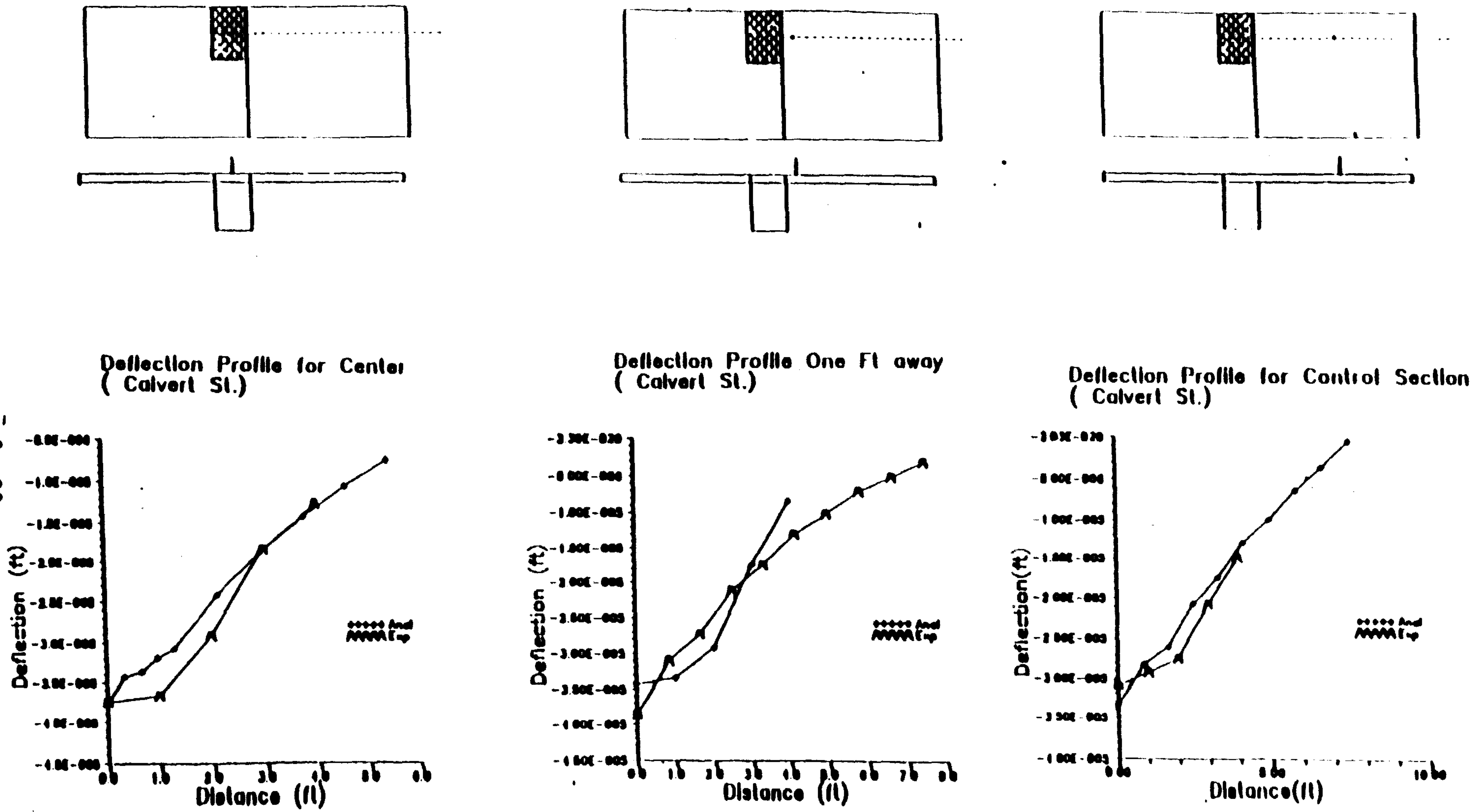

FIG. 3.14. Deflection Profiles of Measured and Analytical Response for Calvert St.

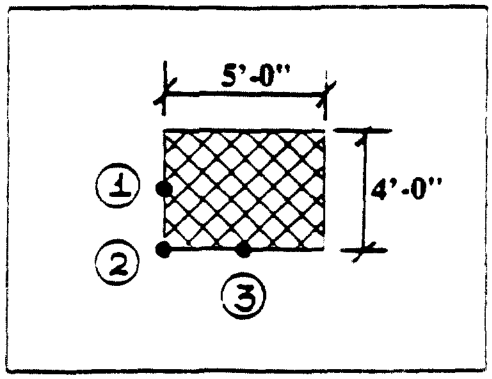

FIG. 3.15. Location and Loading of Center Cut

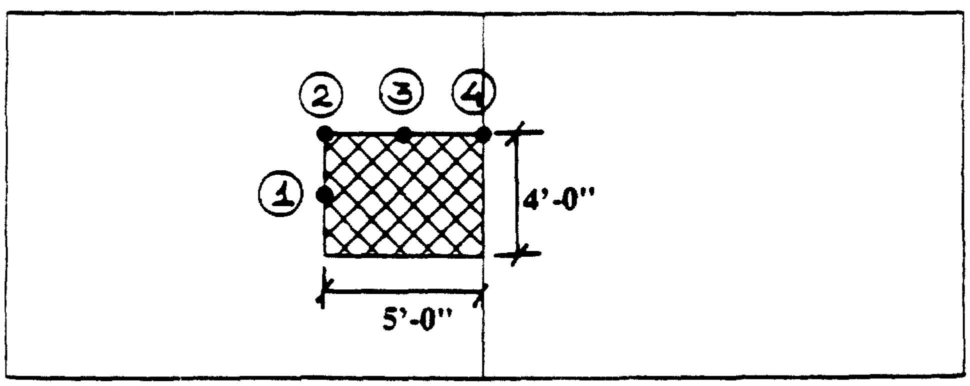

FIG. 3.16. Location and Loading of Edge Cut at Interior Joint

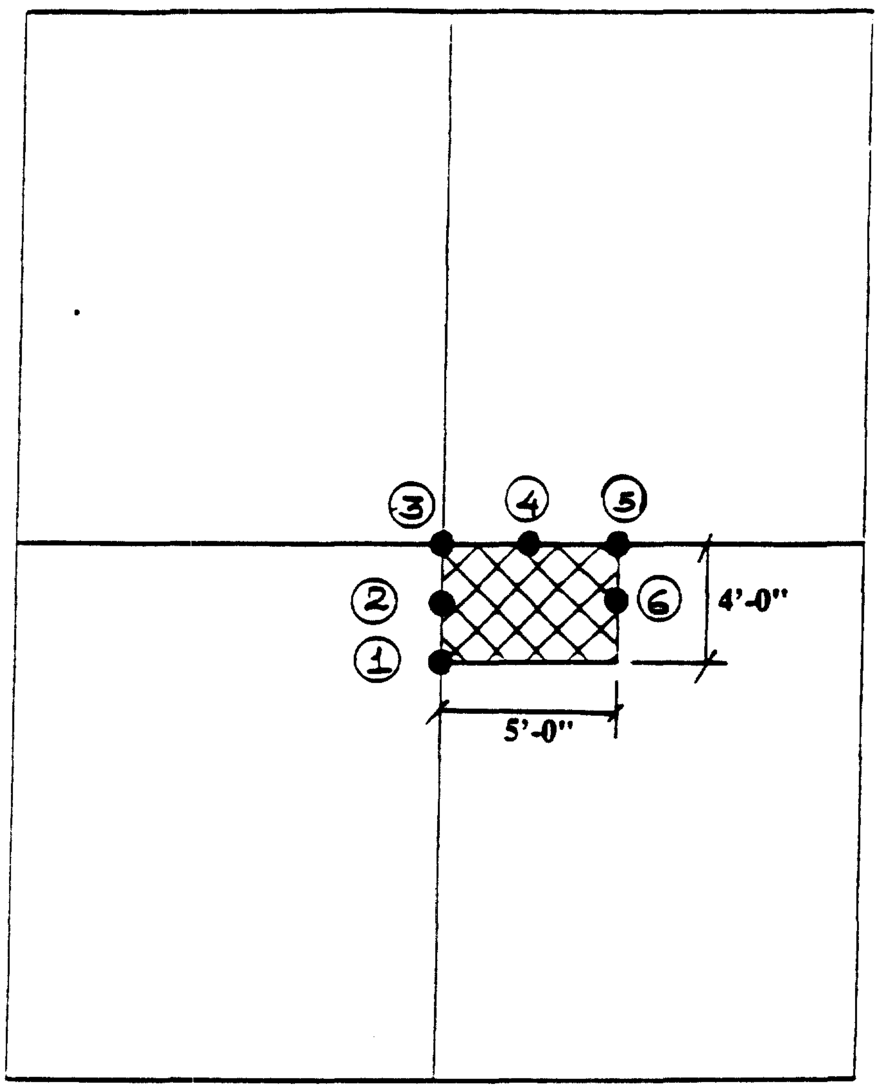

FIG. 3.17. Location and Loading of Interior Corner Cut

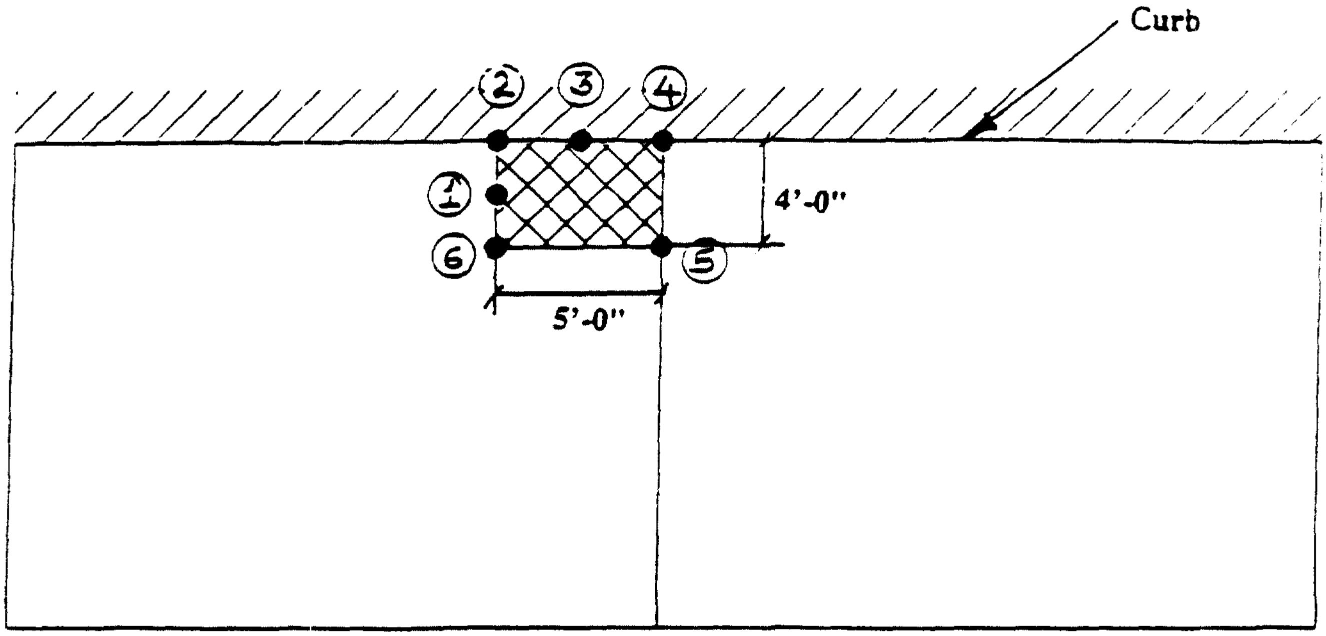

FIG. 3.18. Location and Loading of Cut at Curb

Load Conditi... (5x4 Cut in the Center)

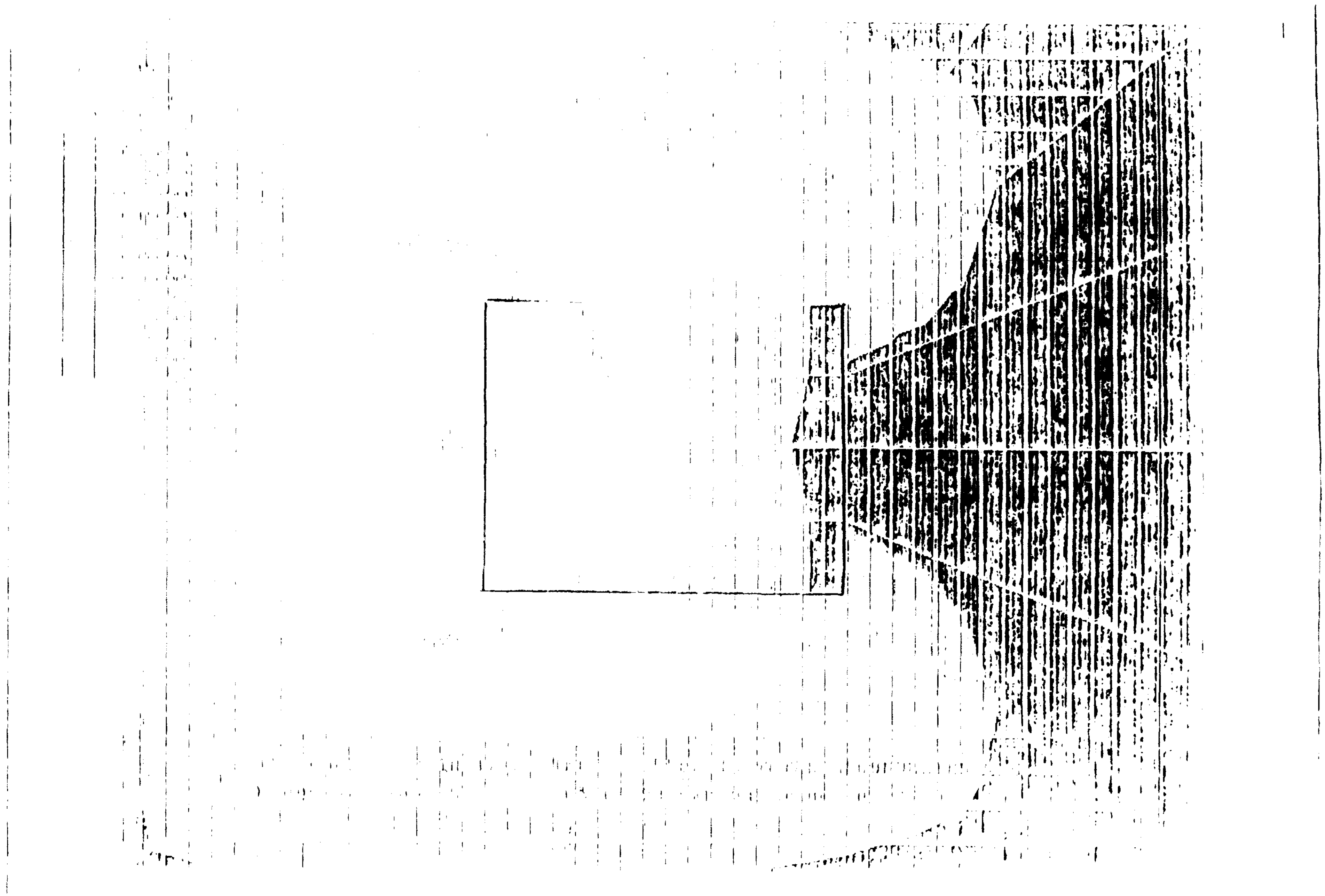

FIG 3.19.a. von Mises Stresses for Center Cut (Load Location # 1)

Load Condition . .4 Cut in the Center)

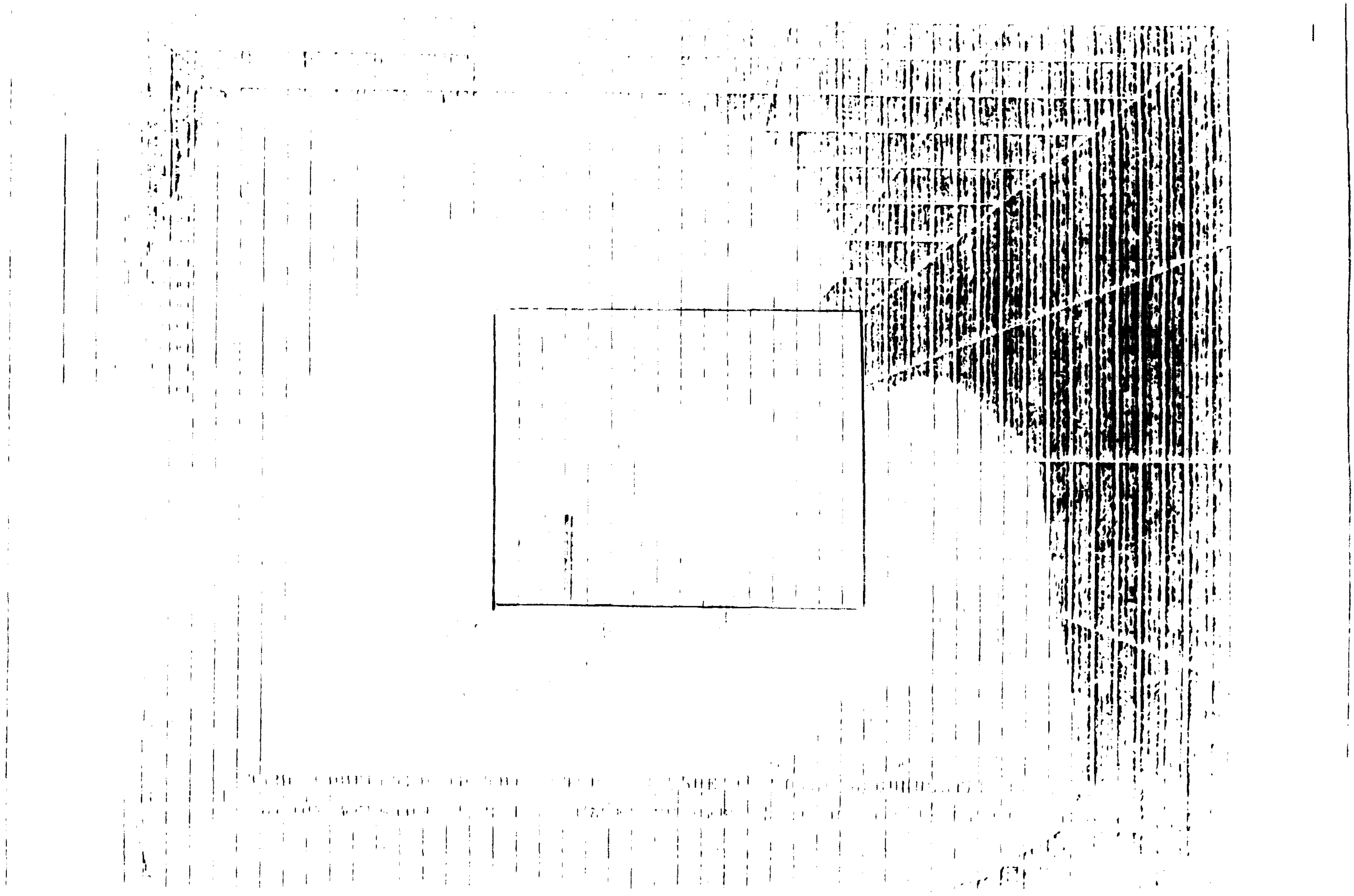

FIG 3.19.b. von Mises Stresses for Center Cut (Load Condition # 2)

CHAPTER 4

REPAIR SCHEMES AND COSTS

FOR

CUTS IN FLEXIBLE PAVEMENTS

Introduction

Deflection measurements and visual evaluation show that utility cuts ordinarily weaken the adjacent pavement, Figure 4.1. In the thirty-six (36) asphaltic concrete and macadam pavement sites studied in detail, Chapter 2, the damage extended beyond the edge of the cut in all directions for an average distance of 3 feet. Thus, for a typical utility cut excavation of 4 feet by 5 feet, the affected area of pavement was 10 feet by 11 feet. It was also shown, Chapter 2, that to restore the disturbed pavement to its original strength will require, under average conditions, the application of an overlay 1.75 inches thick.

Visual investigation of PCC pavements showed that ordinary cuts in PCC pavements and the pavements surrounding them require no special restoration maintenance when the restoration is carried out in accordance with the City of Cincinnati Specifications of Restoration Standards. Furthermore, from the Finite Element Analysis of Portland Cement Concrete pavements, Chapter 3, the impact of utility cuts on the surrounding pavement and subgrade was found to be acceptable, except in those cases when the cut was placed near a joint at the edge of a slab, or along the curb.

In this chapter, four possible repair schemes with associated costs are described for restoration of asphaltic concrete and macadam pavements

It should be noted, that presently there are no established procedures to strenghten flexible pavements around poorly restored utility cuts. For estimating the costs involved, the cost of laying a 1.7 inch thick overlay has been used. However it is realized that to remedy a local weakness in a flexible pavement (around a cut), a customary AC overlay may not be totally effective, or even practical. Therefore, the researchers present possible schemes for cost estimates only. The effectiveness of any scheme can only be evaluated by field trials. The details of possible schemes and their cost estimates are presented in the following sections.

Proposed Repair Schemes

All of the repair schemes are designed to restore the pavement to its original strength or capacity. The designs are based on a utility cut opening of 4 feet by 5 feet, assume pavement subgrade damage 3 feet in all directions beyond the edges of the cut, and assume the strength requirement of an additional 1.75 inches of AC over the "standard" AC or macadam pavement. In all the repair schemes, it is assumed the trench has been properly backfilled by the utility contractor. The construction costs used in estimating the cost of the various repair schemes were based on unit prices provided by three independent paving contractors.

Scheme 1 consists of placing an additional 1.75 inch layer of AC over the patch and adjacent pavement, extending laterally a distance of 3 feet to all sides, then extending an additional 1.75 feet on a taper to zero at the original pavement surface. The new pavement surface thus would cover an area of approximately 196 square feet. The estimated cost of this technique, Figure 4.2, is $1,000. This scheme, while likely acceptable strengthwise, is not practical on a 196 square foot overlay because the edges (transition) would be rough and adversely affect ridability

Scheme 2 is intended for the restoration of a typical 7 inches thick asphaltic concrete pavement. It uses Gilsonite Asphalt which has approximately 50 percent higher tensile strength than ordinary asphalt Thus replacing a 3.5 inch thick portion of the 7 inch asphalt with Gilsonite Asphalt would not only replace the removed asphalt, but would also provide additional strength equivalent to an 1.75 inches thick overlay on top of the original pavement. The scheme, therefore, consists of removal of 3.5 inches thick portion of the AC pavement over the cut area and 3 feet beyond the cut edges, and replacing the removed material with Gilsonite Asphalt. This will provide increased strength without changing the thickness of the pavement. The estimated average cost using the Gilsonite repair technique, Figure 4.3, is $950.

Scheme 3 is intended for the restoration of asphaltic concrete pavement. It consists of removal of the AC pavement and portion of the subgrade over the cut area and 3 feet beyond the cut edges to a depth of 8.75 inches, followed by placement of an 8.75 inch AC pavement over the entire area of 110 square feet. Average cost using this technique, Figure 4.4, is $1400.

Scheme 4 is intended for the restoration of macadam pavement typically composed of 2 inches thick AC and 8 inches thick base. It consists of increasing the thickness of the AC by 1.75 inches. This is done by removing the pavement and portions of the subgrade over the cut area and 3 feet beyond the cut edges to a depth of 11.75 inches, placement of compacted base course to within 3.75 inches of the finished surface, then placement of 3.75 inches of AC over the entire area of 110 square feet. Average cost of this scheme, Figure

4.5, is $1,000.

The proposed strengthening schemes are conceptual and tentative only but they are believed to be technically effective and constructible. They are presented here for cost estimates. It is recognized that their proof of performance will require actual construction and evaluation.

From the above segments, the cost of the cut repair varies from $950 to $1,400. If the City of Cincinnati permits 6,000 to 10,000 cuts each year, and 35% of these are made in flexible pavements, then the annual cut repair costs may range from $1,995,000 ($950 * 0.35 * 6,000) to $4,900,000 ($1,400 * 0.35 * 10,000).

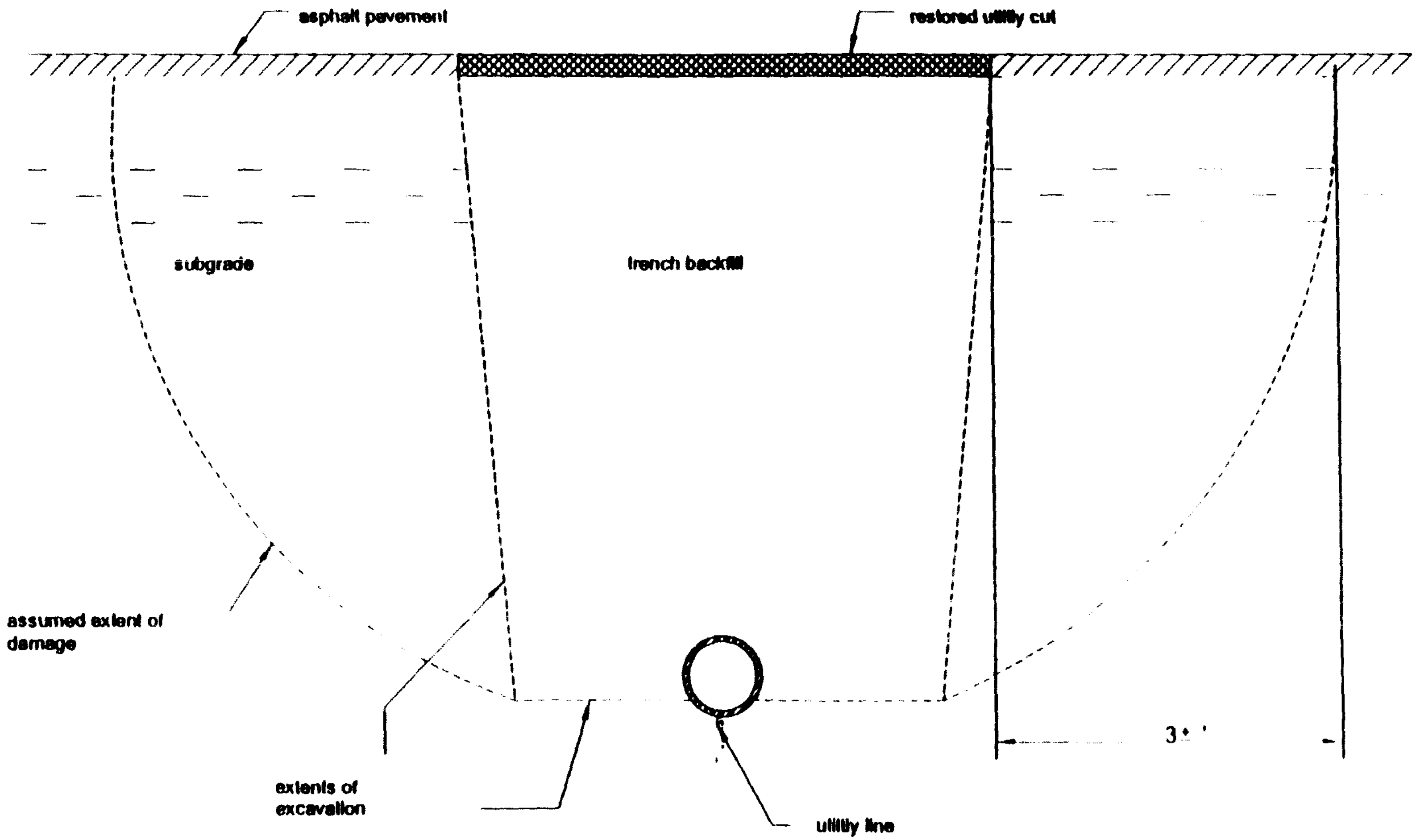

FIG. 4.1. Zones of Weakened Subgrade Due to Utility Cut

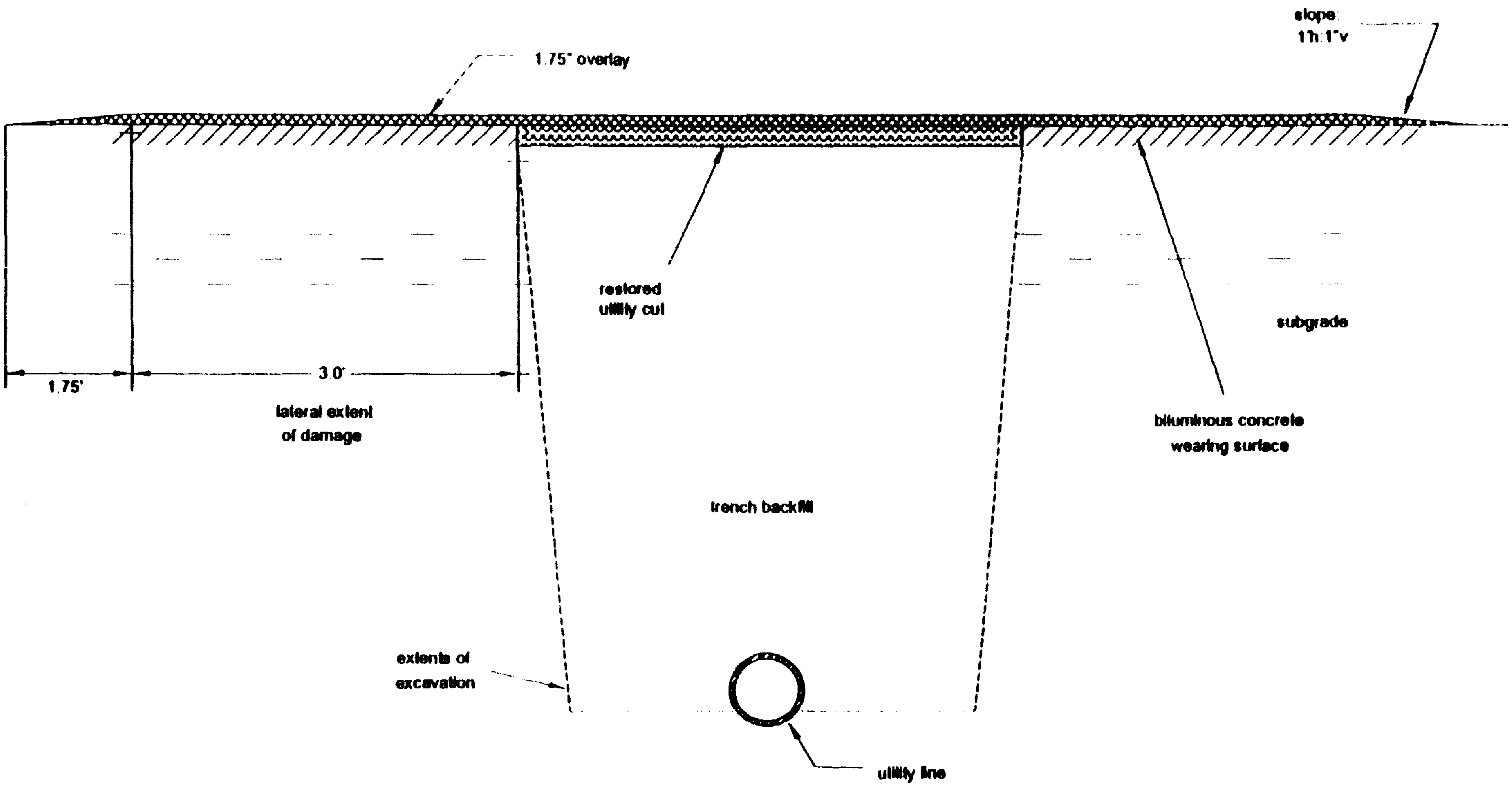

FIG. 4.2. Pavement Strengthened by 1.75 in. AC Overlay - Scheme 1

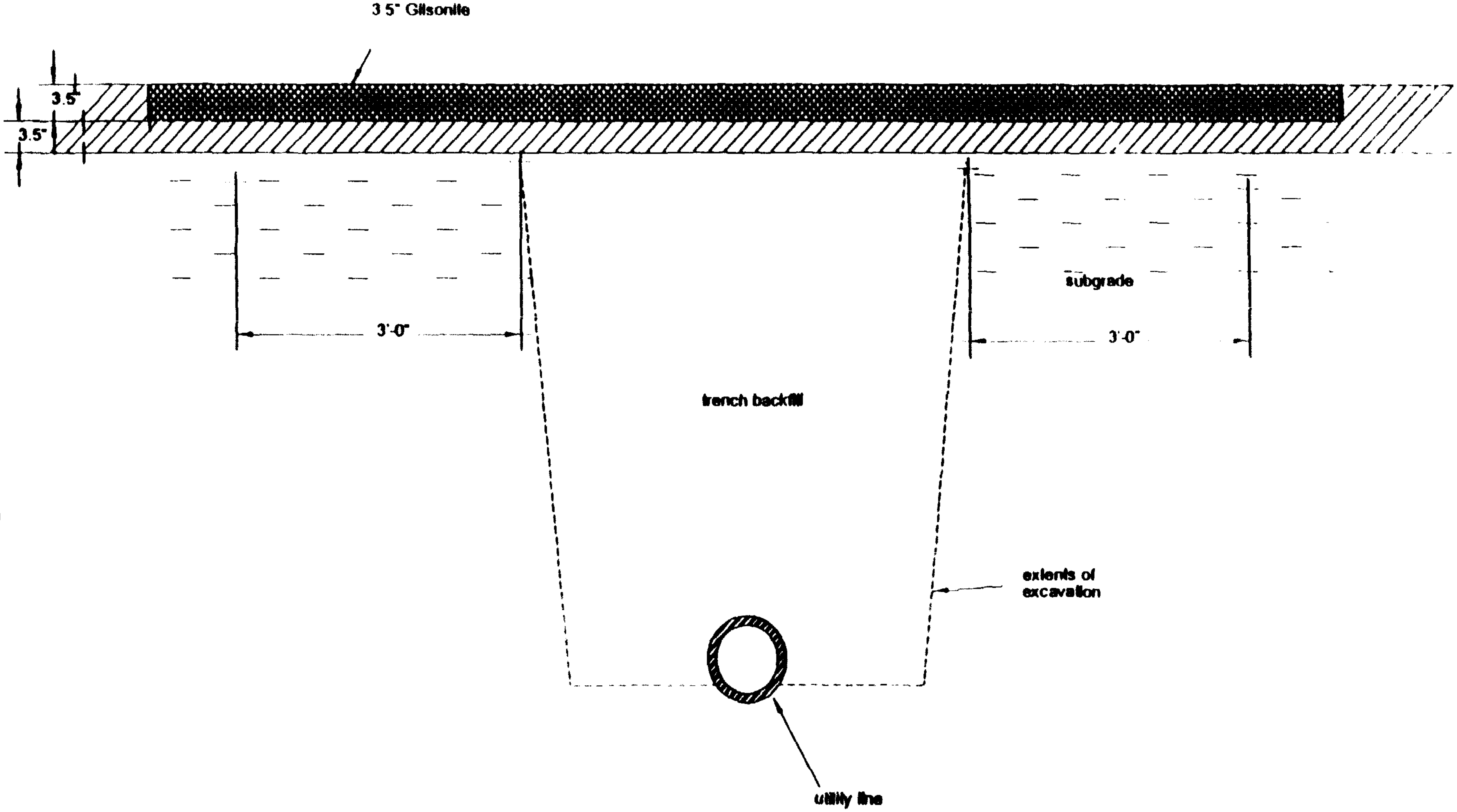

FIG. 4.3. Pavement Strengthening by Replacing a 3.5 in. Thick Portion of AC Pavement with 3.5 in. Thick Gilsonite Asphalt Pad - Scheme 2

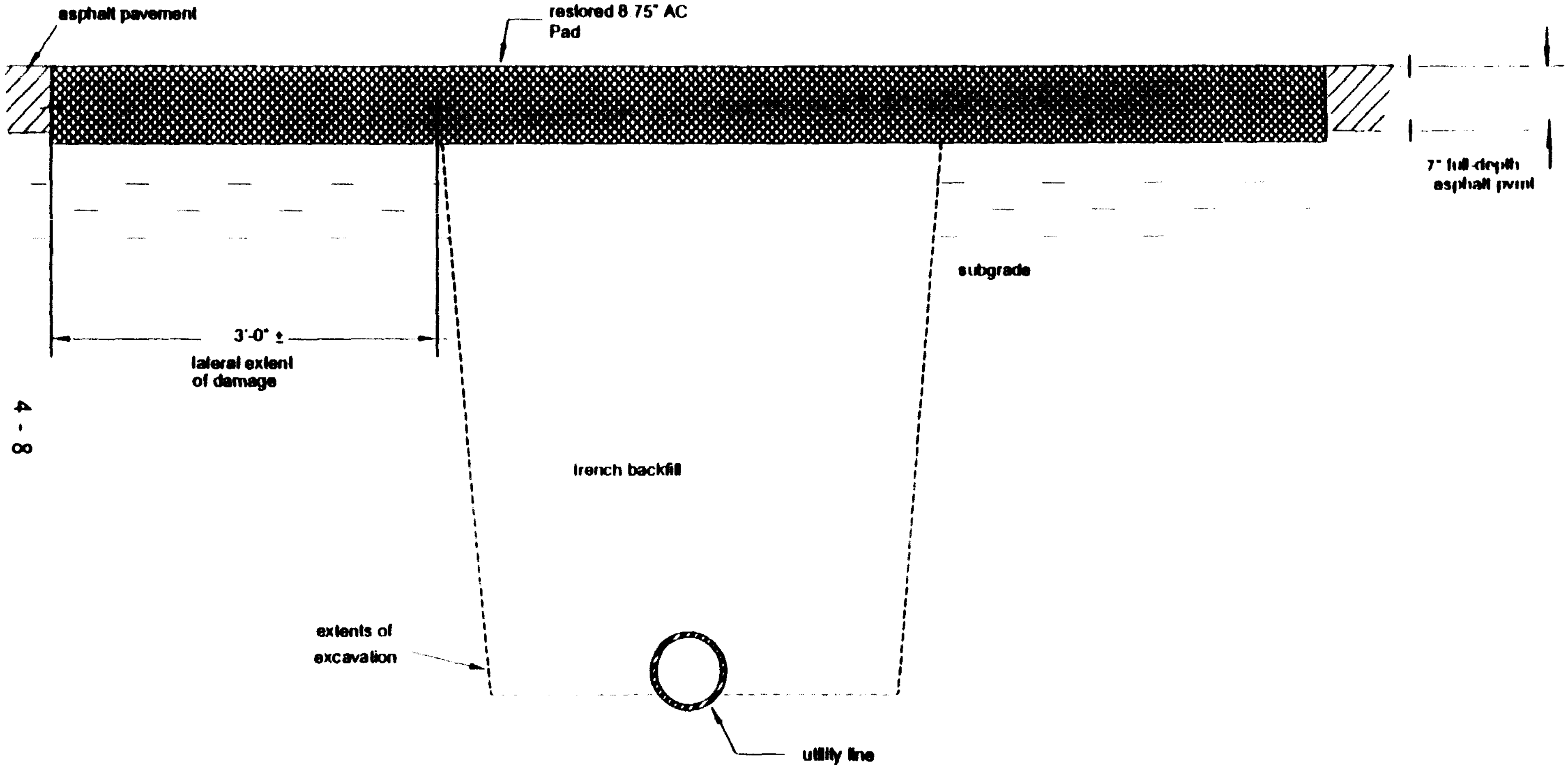

FIG. 4.4. Pavement Strenthening by Replacing the 7 in. Thick AC Pavement with an 8.75 in. AC Pad - Scheme 3